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D. Clay Sisson
Albany Quail Project & Dixie Plantation Research, Albany, GA

Theron M. Terhune II
Tall Timbers Research Station and Land Conservancy

William E. Palmer
Tall Timbers Research Station and Land Conservancy

Reggie Thackston
Tall Timbers Research Station and Land Conservancy

CONTRIBUTIONS OF TRANSLOCATION TO NORTHERN BOBWHITE POPULATION RECOVERY

D. Clay Sisson[1]
Tall Timbers Research Station & Land Conservancy, Albany Quail Project, 5765 Pigeon Road, Newton, Georgia 39870, USA

Theron M. Terhune II
Tall Timbers Research Station & Land Conservancy, 13093 Henry Beadel Drive, Tallahassee, Florida 32312-0918, USA

William E. Palmer
Tall Timbers Research Station & Land Conservancy, 13093 Henry Beadel Drive, Tallahassee, Florida 32312-0918, USA

Reggie E. Thackston
Georgia Department of Natural Resources, Wildlife Resources Division (retired), Forsyth, Georgia 31029, USA

ABSTRACT

The National Bobwhite Conservation Initiative (NBCI 2.0) is a range-wide plan for recovering northern bobwhites (*Colinus virginianus;* hereafter, bobwhite[s]). Using geospatial analysis informed by expertise from practitioners, the plan categorizes landscapes into restoration potential by weighing biological constraints and opportunities such that targeted habitat management will produce bobwhite population growth. A fundamental assumption of the NBCI 2.0 for achieving recovery goals is that bobwhite source populations currently exist on the landscape at densities necessary to (re)colonize newly established or improved habitat. However, we have found that these source populations can be very low or non-existent, especially in northern tiers of the bobwhite distribution. In 1997, we initiated research to evaluate bobwhite population response following translocation using birds from high density populations to newly developed habitats with low bobwhite numbers (<1 bird per 0.62 ha). We worked collaboratively with the Georgia Department of Natural Resources in 2006 to develop and implement a wild bobwhite translocation policy based on key findings from that research. Since that time 3,866 wild bobwhites have been trapped and translocated from properties in the Albany and Greater Red Hills region of Florida and Georgia to 13 recipient sites in 6 states (AL, GA, MD, NC, NJ, and SC) on 29,780 ha. A typical translocation was conducted for 2 – 3 years in March by capturing, tagging and transporting birds overnight for release at an average rate of 1 bird per 7 ha per property. Prior to translocation, each recipient property underwent extensive habitat restoration and agreed to conduct a monitoring program including spring whistle counts and fall covey counts before, during, and after translocation. Bobwhite populations increased on recipient sites from an average of 0.38 (CI: 0.13 – 0.63) birds per hectare to 2.2 (CI: 1.45 – 2.95) birds per hectare resulting in the establishment of huntable wild bobwhite populations adding approximately 42,714 bobwhites to the landscape. The value of these wild bobwhites was determined to average $736 per translocated bird bringing the total value of birds donated from the Albany and Greater Red Hills region for translocation to $2,844,564. The establishment of population hubs through translocation contributes to population recovery efforts outlined in the NBCI 2.0, especially where source populations are limited.

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Key words: *Colinus virginianus,* Florida, Georgia, habitat, National Bobwhite Conservation Initiative, NBCI 2.0

INTRODUCTION

The National Bobwhite Conservation Initiative (NBCI 2.0) encourages intentional habitat management to benefit northern bobwhites (*Colinus virginianus*; hereafter, bobwhite[s]) and grassland and/or shrub obligates. Specifically, the call to maintain management on existing areas with wild bobwhite, development of new areas managed for wild bobwhite, and the establishment of habitat epicenters to facilitate population recovery was identified in the national plan as precursors to success (Palmer 2011). The widespread decline of bobwhites has resulted in local, and in some cases regional, extirpation of bobwhites (Brennan 1991) yet where quality habitat exists at a scale suitable for long-term sustainability bobwhite populations have remained stable to increasing (Brennan 1991, Terhune et al. 2007, Stribling and Sisson 2009). Smaller habitat patches and more isolated bobwhite populations are not only more prevalent in today's landscape but are much more vulnerable to extirpation due to stochastic events (e.g., weather), especially in northern tiers of their distribution (Janke

[1] *Email: clay@pinelandplantation.com*

and Gates 2012, Janke et al. 2015). Therefore, restorative habitat management may not result in short-term increases in bird abundance, if at all, especially where the landscape lacks consistent source populations of bobwhites. In these cases, habitat management alone may not result in bobwhite population recovery.

Translocation as a tool to restore or augment current bobwhite populations has been successfully applied to contiguous and fragmented sites in the Southeast (Terhune 2008, Terhune et al. 2005, 2006 and 2010). Despite these successes, some still question the reliability of the technique alone for broad-scale population recovery (Brennan 2012). Terhune et al. (2010) emphasized that translocation was not a substitute to management and highlighted that careful site selection and habitat management were precursors to its success. As such, high density bobwhite populations serve as source populations for translocation and may provide an opportunity to develop new population hubs for restoring bobwhites where habitat exists at sufficient quality and scale and where birds have been extirpated due to inclement winter weather (Palmer et al. 2011, Janke et al. 2015).

To date, the cost of wild quail management and translocation has also not been well documented. The estimated annual economic impact of working lands in the Red Hills and Albany regions are $147.1 million and $125 million, respectively (Fleckenstein 2013 and 2014). The Center for Economic Forecasting and Analysis at Florida State University additionally estimates that $115 million and $82 million, respectively, is a direct result of expenses associated with intensively managed quail lands (Fleckenstein 2013 and 2014). These impacts reflect annual operating expenses, capital improvement expenses, discretionary spending, and charitable giving, but proportional expenses attributed directly to the production of wild bobwhites is currently lacking. Given that the annual expenses reported in Fleckenstein (2013 and 2014) are beyond that required to maintain a population of wild bobwhites and would over-estimate the value of a wild bobwhite, we collected annual budget information for private properties in the Red Hills and Albany Area to determine annual costs associated specifically with bobwhite habitat management. Additional costs were evaluated as well to determine the total value of trap and translocated wild quail.

The history of wild bobwhite translocation and development of Georgia's translocation policy was summarized in Sisson et al. (2012). At that time the implementation phase of these projects had just begun with a total of 945 birds translocated onto 8,860 ha. Since that time, significant progress has been made with this program as it was expanded in both size and scope. As a result of preliminary findings and more recent successes, widespread interest in the utility of translocation as a conservation tool has gained traction. But, the overall contribution and cost of translocation to population recovery efforts has not been documented. Brennan et al. (2012) pointed out the glaring omission of success stories in previous National Quail Symposiums and called for an increased effort at publishing them, as this would be how the success of NBCI 2.0 would be judged. Herein, we describe the contributions made towards the NBCI 2.0 wild bobwhite recovery goals by the wild quail translocation program being conducted by Tall Timbers Research Station's Game Bird Program and our partners.

STUDY AREA

Donor sites for this effort were all privately owned wild quail properties in the "Plantation Belt" of southwest Georgia and north Florida in the vicinity of Albany and Thomasville, GA and Tallahassee, FL (Figure 1). Two of these properties, Tall Timbers and Dixie Plantation, are owned and operated by Tall Timbers Research Station and Land Conservancy (TTRS). All donor properties have a long history of wild quail management and hunting, maintaining high density (>2.5 birds per ha) wild bobwhite populations (Brennan et al. 2006, Sisson et al. 2012), with many of these populations supporting >1 (range: 0.42 – 8.65) birds per hectare on these sites. There have been 13 recipient sites to date in 6 states (AL, GA, MD, NC, NJ, and SC) ranging in size from 600 to 5,600 ha (Table 2 & Figure 1). Recipient sites were all large (>600 ha), privately-owned properties that are comprised predominantly of open pine (*Pinus* spp.) timber with integrated wildlife openings. These recipient sites have all undergone habitat modification/improvement before translocation was conducted and operate under a long-term management plan incorporating regular prescribed fire (<3 year fire-return interval), low-density timber (10 – 65 BA with an average of 35-40 BA) and wildlife openings incorporating fallow field management and/or crop rotations. In addition, post-burn mowing or roller chopping is commonly applied to reduce mid-story hardwood encroachment as well as reduction of mature hardwoods in upland sites. Many of these properties also implement year-round supplemental feeding and year-round mammalian predator control to maintain targeted (<15% predator index) predator activity levels. The predator index is calculated as the proportion of scent stations hit by target mammalian meso-predators. During translocation, quail hunting is precluded from these recipient sites to allow for maximum over-winter survival and carryover to breeding season for optimal reproduction in subsequent years.

METHODS

Translocation

Translocation was conducted between 2003-2016 in every year but 2005, and occurred in March following the protocol outlined in Terhune et al. (2005, 2006, 2010) where birds were captured using baited funnel traps (Stoddard 1931) held and/or transported overnight, and released at the recipient site the following day. Each bird was leg banded, weighed, and classified by sex and age. Some projects included a research component involving radio telemetry in which a sample of birds were radio-tagged with 6g necklace style radio-transmitters (Holohil Systems, Carp, Ontario, Canada). All trapping and

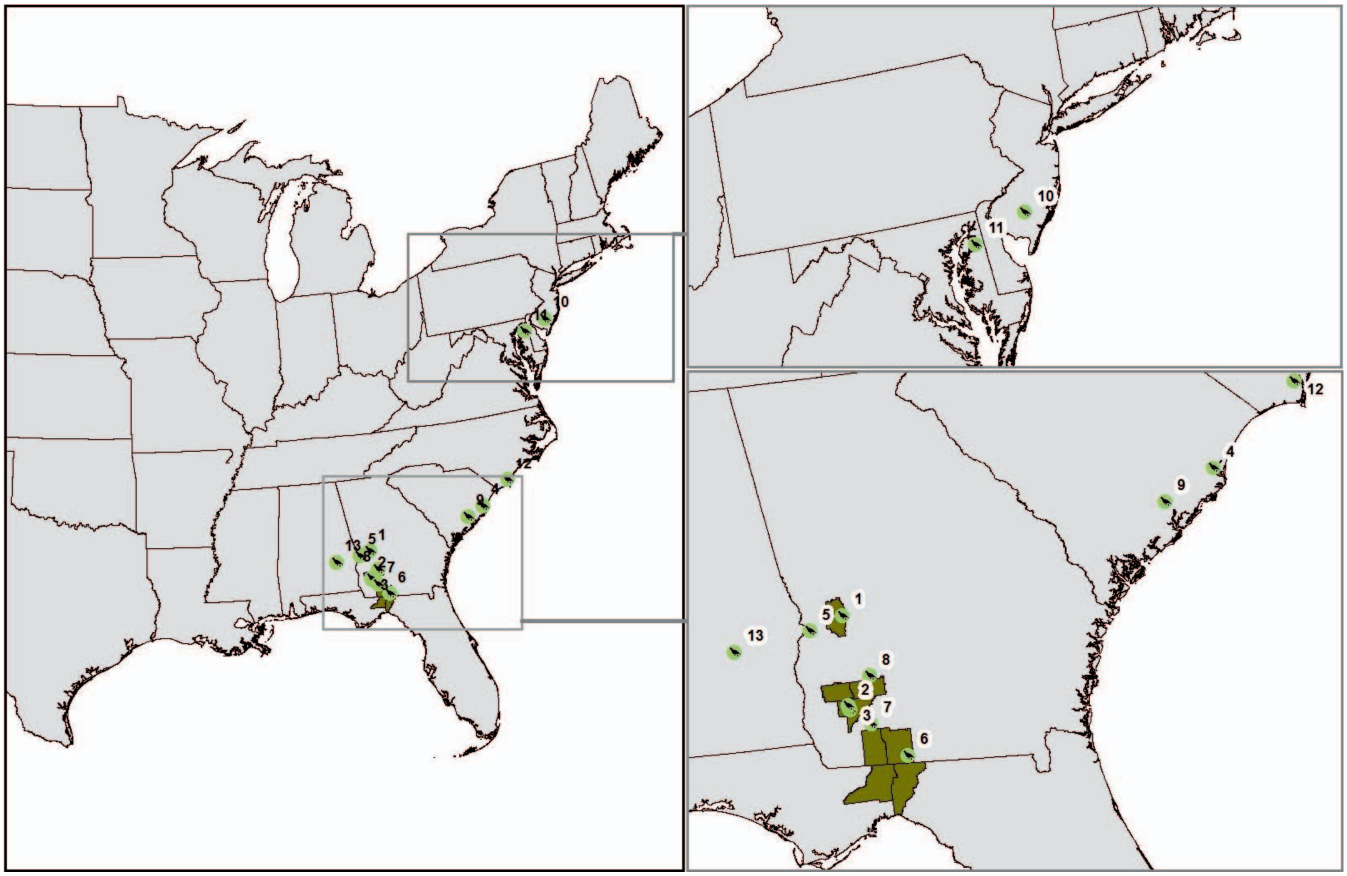

Fig. 1. General location of sites in south Georgia and north Florida (green shaded counties) that donated 3,866 wild northern bobwhites for translocation between 2003-2016 as well as location of 13 sites (indicated by bobwhite icons and labelled as site numbers 1 – 13) receiving the translocated birds in 6 states.

handling procedures were approved by either Auburn University's (2002-2007: AU-2002-0364) or Tall Timbers Institutional Animal Care and Use Committee (IACUC numbers: TTRS, GB-2001-01 and GB-2001-01-15) and permitted by either the Georgia Department of Natural Resources, Wildlife Resources Division (GA DNR WRD) or the Florida Wildlife Commission (FWC). Personnel from TTRS Game Bird Program served as the "agent" for each translocation.

Monitoring

Bobwhite populations were monitored at all translocation sites prior to, during, and after translocation using spring whistle counts and fall covey point counts (both assuming a 500-m detection radius) as an index to population change over time. Spring whistle counts followed the standard protocol developed by Terhune et al. (2009) which was based on previous research (Curtis et al. 1989, Ellis et al. 1969, Hanson and Guthery 2001, Rosene 1969, Wells and Sexon 1982) where a series of points was visited by an observer recording individual males heard for five minutes during the first two hours after sunrise. The number of points for each property varied with the size of the property whereby a minimum of 20% of the total area was targeted for sampling and systematically stratified across the property to ensure adequate spatial coverage. We ascertained the peak calling week by calculating the average number of individual calling males at all points for each study site. We conducted weekly counts during the first peak of calling activity (late May – early June) which has been shown to correlate well (R^2 = .975) with autumn abundance on our study areas in south Georgia and north Florida (Terhune et al. 2009). We used covey call indices (DeMaso et al. 1992, Seiler et al. 2002, Wellendorf et al. 2004) from mid-October to late November and estimated abundance using the point count method via the fixed radius approach adjusted for calling rate based on factors outlined in Wellendorf et al. 2004 (e.g., wind speed, barometric pressure, and adjacent calling coveys). Upon determining the adjusted number of coveys per point, we used a multiplier for the number of birds in a covey to calculate the total number of birds in a sampling area and divided that number by the size of the area sampled (78.5 ha*number of points) to obtain the bird density (birds per hectare) for a given property. The average covey size was determined by using pointing dogs during fall census as well as flushing of radio-tagged coveys on sites when available. The point counts conduced in the fall were the same points as the spring whistle counts and repeated 2 times. Whistle counts were used as a measure of trends in the population over time while covey counts gave a measure of autumn density (birds per hectare) and were

Table 1. Average annual costs (on a per acre basis) for typical northern bobwhite land management activities in the southeastern United States

Budget Item	Included in Estimation of Value per Bird	CPA[a]	SD[b]
Salaries/Payroll	Yes	$32.47	$12.82
Payroll Benefits/Taxes	Yes	$12.68	$5.51
Vehicles	Yes	$1.19	$0.76
Woods Management / Land Clearing / Forestry [c]	Yes	$19.62	$6.34
Quail Management & Development [d]	Yes	$7.43	$3.57
Contract Services [e]	Yes	$5.17	$4.21
Equipment Purchase/ Lease [f]	Yes	$5.49	$4.76
Equipment Maintenance/ Repairs	Yes	$4.95	$3.43
Fuel & Travel	Yes	$4.96	$1.85
SubTotal		$93.96	$25.31
Other Expenses			
Buildings/Ground Maintenance	No	$7.31	$3.29
Utilities	No	$4.62	$2.12
Property Tax & Insurance	No	$5.81	$5.59
Dog Program	No	$3.52	$3.42
Horse Program	No	$2.82	$2.74
Miscellaneous	No	$0.90	$0.59
Recreation	No	$2.52	$2.74
Depreciation/Amortization	No	$6.44	$3.69
SubTotal		$33.94	$24.19
Total		$127.90	$41.23

[a] Cost per acre.
[b] Standard deviation.
[c] Land clearing includes snag cleanup, hardwood reduction, pile management, and etc.
[d] Quail Management and development includes prescribed burning, fallow field creation and maintenance, supplemental feeding, predation control, and etc.
[e] Contract services include prescribed burning, chemical (herbicide) purchase and application
[f] Equipment Purchase or lease includes purchase of new equipment such as tractors, ATVs and land management implements (e.g., mowers, harrow/disk, roller chopper, spreader, etc.) or lease of equipment such as tractors, front-end loaders, excavators.

used to calculate the number of birds produced over time by the translocation and management efforts.

Estimating Value per Bird

We collected annual budget information for private properties (n = 17) in the Red Hills and Albany Area to determine annual costs associated specifically with bobwhite habitat management. We identified expenses directly associated with land management activities and calculated the average cost per acre managed for each budget item category available for each property and excluded those budget items not directly associated with land management activities such as property taxes and insurance, housing maintenance and utilities, bird dog programs, horse programs, and general recreation (see Table 1). We ascribed the value of an individual wild bobwhite in the Red Hills and Albany region by estimating annual operating cost associated with the production and maintenance of a wild populations with the underlying assumption that a translocated bird is equivalent to a harvested bird when harvest is considered compensatory and not additive. This was considered a conservative, "best case" scenario but may not apply to all sites and regions. Thus, we estimated the value of a translocated wild bobwhite (VB) as:

$$VB = MC + OC + TTC$$

where, MC is the cost associated with land management, OC is the opportunity cost, and TTC is the trap and transport cost associated with translocation. Subtracting TTC would then provide the value of a wild bobwhite in the Red Hills and Albany area. We calculated the management cost as:

$$MC = \left(\frac{Annual\ Land\ Management\ Budget}{FA{*}HR{*}WA}\right)$$

where, the annual land management budget includes only those land management activities directly associated with the management of bobwhites, FA (fall abundance) is the estimated total number of birds on a property during the October/November fall census, HR is the harvest rate of 0.15 which reflects the recommended harvest rate to maintain long-term population persistence in the Southeast, and WA is winter attrition due to natural predation. A 15% harvest rate is recommended (W.E. Palmer, unpublished data) to mitigate potential additive take of bobwhites during any given hunting season, and the number of translocated birds donated plus the total birds harvested should not exceed this 15% recommended harvest rate to preclude any additive harvest effects. In our study, since all donor properties stayed at or below the 15% recommended harvest rate including birds removed for translocation purposes, WA was 1 (i.e., no effect) since translocation was considered compensatory in our populations. However, in populations where harvest is considered additive we suggest WA should reflect that the value of a bird in mid-March which is higher than in mid-October such that WA would be calculated as:

$$WA = DSR^{\#days}$$

where, DSR is the mean daily survival rate and # days represents the number of days passed since the timing of the fall census. For example, on our sites in the Southeast average DSR during the fall/winter time period is 0.9975 and 135 days pass from the time of our fall census and the start of translocation suggesting that survival during that period is 0.56 (or 56% of

Table 2. Site number, recipient location (county), size, years conducted, number of translocated birds, pre- and post-translocation density, and birds added to the landscape on sites receiving wild northern bobwhite translocations from South Georgia and north Florida conducted by Tall Timbers Game Bird program from 2003-2016.

							Density (birds per ha)		
Site #	County	State	Size (ha)	Distance (km)	Years	# Birds	Pre	Post	# Birds Added
1	Marion	GA	1,200	116	2003-2004	127	0.75	3.25	3,000
2	Baker	GA	800	16	2006	100	0.50	1.25	600
3	Baker	GA	720	13	2007-2009	219	0.35	1.56	871
4	Georgetown	SC	2,200	687	2009-2011	401	0.38	3.50	6,864
5	Stewart	GA	1,920	115	2011-2013	524	0.08	2.38	4,416
6	Thomas	GA	1,000	28	2011	60	NA	NA	NA
7	Mitchell	GA	600	21	2012-2013	105	0.13	1.00	525
8	Lee	GA	3,360	43	2012-2014	327	0.38	3.00	8,820
9	Berkeley	SC	3,600	470	2013-2016	451	0.38	1.88	5,418
10	Burlington	NJ	5,600	1,292	2015-2016	164	NA	NA	NA
11	Kent	MD	2,700	1,207	2015-2016	128	NA	NA	NA
12	Brunswick[a]	NC	4,480	680	2013-2017	1,058	0.25	2.75	11,200
13	Bullock[a]	AL	1,600	170	2015-2017	202	0.63	1.20	1,000
Total			29,780			3,866			42,714

[a] Translocation still in progress through 2017

[b] Bobwhite density (birds per hectare) was calculated by using point counts following Wellendorf et al. 2004 to obtain an adjusted number of coveys (corrected for factors influencing calling rate), multiplied by the average covey size observed per site, and divided by the total area sampled (78.5 ha * number of points).

[c] NA values indicate data that was unavailable due to monitoring constraints during some years on some sites.

bobwhites alive during mid-October remain alive during mid-March; see Terhune et al. 2007).

The opportunity cost (on a per bird basis) was calculated as:

$$OC = \left(\frac{Cost\ of\ a\ Wild\ Bobwhite\ Hunt}{Daily\ Bag\ Limit}\right) - MC$$

where, the average current cost of a wild quail hunt (~\$7000 per day) and the daily bag limit for the hunt (24 quail for a 2-person wagon limit). We calculated the cost associated with trap and transport for each translocation conducted since 2003, where data was available, as:

$$TTC = \frac{(PT + TP + PB + Trap + Transport + Misc)}{\#birds}$$

where, PT is personnel time required for all activities associated with trapping (pre-baiting, running traps, working up birds, and travel); TP is the expense associated with permitting and health screening (extracting blood samples or mouth swab for disease testing); PB is costs incurred relative to pre-baiting including truck mileage, fuel, and bait; Trap is the cost incurred from running traps which includes trap materials, truck mileage, fuel, and bait; Transport is the cost associated with transporting of birds from the source sites to the recipient site including truck mileage and fuel; Misc includes miscellaneous charges associated with translocation (overnight stays during transport of birds, shipping of bird samples for health screening, etc.); and, # birds represents the total number of birds captured and moved during a translocation.

RESULTS

During 2003-2016 we translocated 3,866 wild bobwhites from donor sites in southwest Georgia and north Florida to 13 recipient sites in 6 states (AL, GA, MD, NC, NJ, and SC). Twelve anonymous, private donor sites in addition to the 2 sites owned by TTRS contributed birds for translocations with care taken in each case to distribute the birds removed among properties so as not to harm the resident populations and adhere to the maximum 15% recommended harvest rate. The typical translocation was for 3 consecutive years and averaged 1 bird released for every 7 ha on the recipient site. The average recipient site (property) size was 2,290 ha with an overall (all sites) combined 29,780 ha of new centers created for wild quail populations. Fall densities on these sites increased from an average of 0.38 (CI: 0.13 – 0.63) birds per hectare to 2.2 (CI: 1.45 – 2.95) birds per hectare (Table 2). We estimated this added 42,714 birds to the landscape, with several of these populations still growing. Population recovery on some sites was dramatic as indicated by both whistle counts and fall covey counts. For example, on the site in Lee County, Georgia only 120 males and 15 coveys total were heard from 9 listening points in the year prior to translocation beginning. Four years later, these numbers had increased to 20 males and 90 coveys heard (Figure 2). This equated to a population increase in fall density from 0.38 birds/ha (CI: 0.16 – 0.65) prior to translocation in 2011 to 3.0 birds/ha (CI: 2.14 – 3.86) in 2015 (Table 2). Similarly, on the site in Brunswick County, North Carolina the spring whistle and fall covey counts increased from a total of 5 males and 10 coveys heard on 20 points initially to 97 males and 114 coveys four years later (Figure 3).

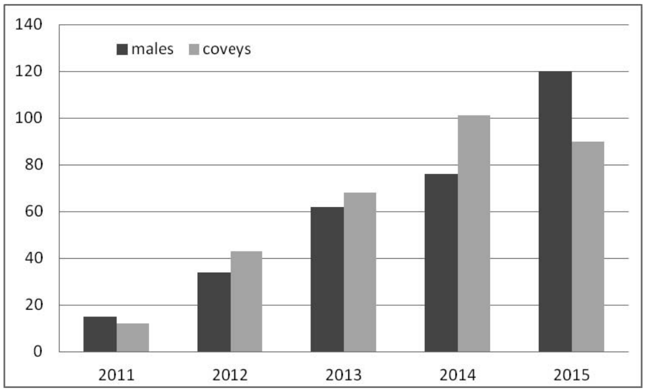

Fig. 2. Total number of whistling males in spring and autumn coveys heard from 9 listening points on a 3,360 ha translocation site in Lee County, GA before (2011), during (2012-2014), and after the translocation of 327 wild northern bobwhites.

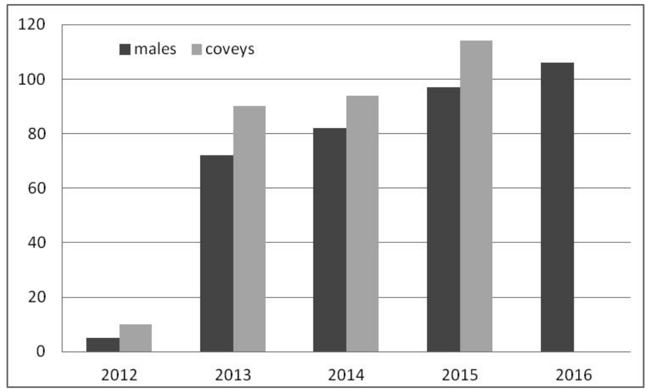

Fig. 3. Total number of whistling males in spring and autumn coveys heard from 20 listening points on a 4,480 ha translocation site in Brunswick County, NC before (2012) and during (2013-2016) the translocation of 1,058 wild northern bobwhites.

The estimated annual management cost associated with bobwhite habitat management was \$93.96 (± 25.31) per acre (Table 1). We found that on average the management cost (MC) was \$398.63 (± 181.33) per bird, opportunity cost (OC) was \$170.92 (± 107.48) per bird, trap and transport cost was \$166.24 (± 65.71) indicating that the total value of a translocated wild bobwhite was \$735.79 (± 267.79). We found that as bird density on source sites increased, OC increases whereas MC decreases and TTC also cost decreases. If this value is applied to all birds donated for translocation (n = 3,866) the total value of birds donated was \$2,844,564.

DISCUSSION

Our results suggest that when translocation is implemented following habitat restoration and/or concurrently with sound habitat management, population growth is expected. However, given our study design (i.e., lack of a true control due to property size constraints) it is difficult to attribute the magnitude of population response exclusively to translocation because improved habitat management occurred simultaneously. Intentional habitat management occurred all our study sites and, in fact, was a pre-requisite for translocation in all cases because previous research has demonstrated the necessity of habitat management for demographic success following release (Terhune 2008, Terhune et al 2005, 2006, 2010). However, it is important to note that these population increases occurred against a backdrop of long-term regional population declines (Sauer et al. 2015), and the extent of population growth on translocation sites ($\bar{x}$= 182% increase ± 55.6%) was much times greater compared the managed sites ($\bar{x}$= 6.9% increase ± 6.4%) not receiving translocation in the Red Hills and Albany areas (see Figure 4). Thus, the numerical benefit of translocation on bobwhite abundance may serve as an added boost to habitat management. Furthermore, this habitat work may not have occurred without the assurance of translocation as an option.

While some of the early research on translocation provided mixed results (Jones 1999, Liu et al. 2002), we remained optimistic since our results in South Georgia demonstrated time and again that translocation worked under proper conditions (Terhune et al. 2005, 2006, 2010). The development of the GA DNR WRD program in 2006, and preliminary results, further bolstered our confidence (Sisson et al. 2012) as well as created a great deal of interest in the program from landowners and other state wildlife agency programs. This is evidenced by the fact that in the first 10 years of the program 8 translocation projects were initiated moving a total of 945 birds, compared to the last 4 years when another 5 projects have been initiated resulting in over 2,000 birds moved. The success of this program has to be considered more than marginally significant as it has contributed to the addition of approximately 42,714 birds to the landscape and helped create 29,780 ha of new wild bobwhite population centers in six states. In our studies, we could not fully infer how genetic differences among source and recipient sites influence the success of translocation since nearly all of our translocations occurred in the Southeast. Previous research has shown that the role of genetics, through ostensible hybrid vigor, genetic swapping or increased heterozygosity, does not likely explain population growth following translocation (Terhune 2008). However, future research should explore how phenotypic traits such as body size and other genotypic expressions such as behavior or habitat selection might influence the success of translocation across greater latitudinal or longitudinal distances.

The need for translocation as a population recovery tool is increasing as evidenced by range-wide population declines, local/regional extirpations (Sauer et al. 2015) and the low initial population densities (<1 bird per 0.62 ha) on some of our study sites even following extensive habitat management (Stribling and Sisson 2009, Sisson et al. 2012). While the average density on our recipient sites was low (0.38 birds/ha) some were as low as 0.08 birds/ha, much lower than what is considered a huntable population (Palmer et al. 2011). Some northern states have closed bobwhite hunting season altogether and have

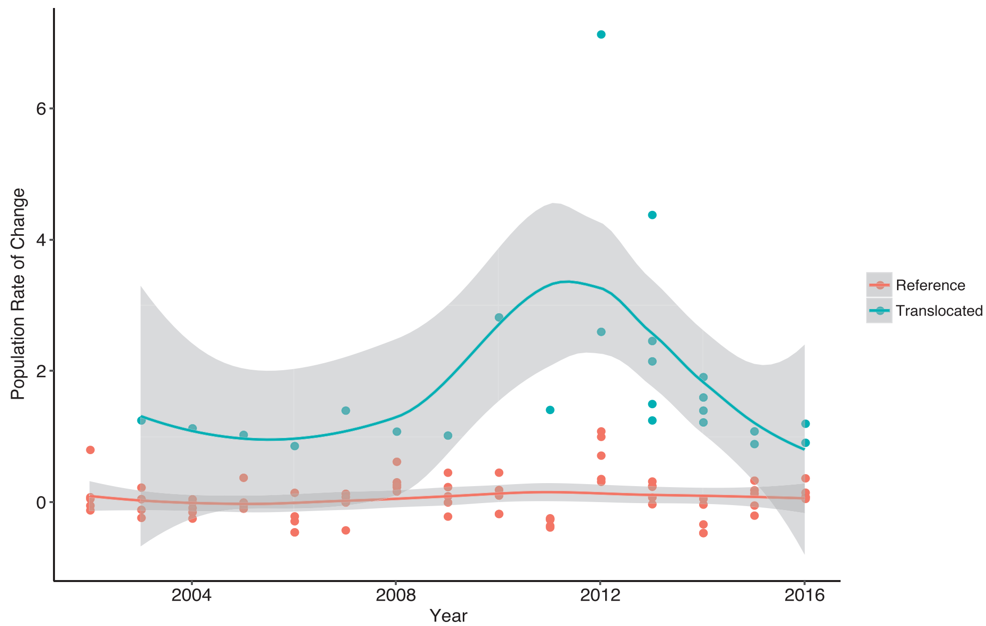

Fig. 4. Northern bobwhite population growth, represented as rate of change from fall to fall, for translocated sites compared to reference sites (n = 5) during 2001 - 2016.

reported no wild bobwhites remaining in some areas or the entire state (see NJ Fish and Wildlife 2015). The possibility of translocation to supplement birds and jumpstart population recovery provides landowners added confidence to move forward with a wild bobwhite management program. While populations on many of our study sites would have likely increased on their own, it may not have been fast enough for these landowners to justify the expense or for the bobwhite population to overcome barriers (e.g., stochastic weather events, lack of conspecifics) to population growth. We believe that individual state translocation protocols are necessary to provide the framework for translocation and set sideboards for minimum criteria required for qualifying as a recipient site. In doing so, the protection of a limited source of birds also indemnifies those landowners contributing birds to the cause.

In the early to mid-1900s bobwhites were byproducts of everyday land use, but today intentional and purposeful management is required to maintain wild bobwhite which can be an expensive proposition, especially in the Southeast (Burger et al. 1999, Palmer et al. 2011). The intensity of management and cost is high in the Southeast and is unparalleled anywhere in the bobwhite distribution. A conservative harvest (<15% of the fall population) is part of the management philosophy and a contributing factor to their long-term success (Sisson et al. 2012), but it also makes the value per harvested bird high. Other studies have shown the value per harvested quail to range from $254 on a lease in Texas (Johnson et al. 2012) to over $300 per bird on a state Wildlife Management Area in Georgia (GA DNR WRD unpublished data) which does not include opportunity cost since commercial hunts are not an option on public lands. We found that the value per harvested wild bobwhite to be $570 per bird and the value of a wild translocated bird to be $736 per bird which may be on the low end of the scale for private plantation properties. At this rate the value of the 3,866 birds contributed to the translocation program was $2,844,564 which underscores the conservation ethic of donor site owners. Not only are these landowners making significant contributions to bobwhite conservation by maintaining stable bobwhite numbers and contributing birds to population recovery efforts, but they also are provide a major boost to local economies – estimated in the millions annually (Fleckenstein 2013 and 2014). The NBCI 2.0 recognized the importance of existing high density populations as sources for both population expansion and translocation (Palmer et al. 2011). Approximately 280,000 ha of private land in Albany and Greater Red Hills region is actively managed for bobwhites. The contribution of these landowners and their staff to quail conservation, the local economy, and now on a regional and even national scale as donors for translocation is laudable. The collective contribution of translocation to population recovery is significant and stems from a dedicated partnership between Tall Timbers, state wildlife agencies, and private landowners. The success of this translocation program underscores the value of partnerships to bobwhite population recovery and wildlife conservation as a whole. Given the limited commodity of wild bobwhites and their socio-economic value, we have a responsibility to judiciously implement translocation with the utmost care and careful consideration of science-based recommendations.

We believe our continued success of translocation is due to strictly following recommendations from past research. Specifically, we view five primary criteria contribute to the success of translocation: (1) large target release area; (2) quality habitat and continued management on the release site; (3) an available source of wild bobwhites; (4) short capture, handling, and holding times;

and, (5) timing of release. Given adequate habitat management and a valid source of wild bobwhites, we also recommend translocating individuals 3–4 weeks prior (during mid-to-late March) to the breeding season to provide ample acclimation time to their new surroundings, but not longer than 3–4 weeks prior to breeding season to reduce potential mortality (see Terhune et al. 2005, 2006, 2010). We recommend (based on movement and dispersal data from previous research – see Terhune et al. 2005, 2010) that release sites should be as large as possible, but minimally should be at least 600 ha to reduce dispersal outside managed habitat. Our experience also has been that survival, subsequent reproduction, and population growth can be suppressed on a property with a prior history of pen-reared releases (D.C. Sisson, unpublished data). As such, we suggest waiting 2-3 years following any release of pen-reared birds prior to implementing translocation on a property. In addition, we believe that birds should be released as soon as possible and not held in captivity for more than 24 hours to reduce stress associated with capture, handling and holding. Future research on identifying proper stocking rate (number of birds released), spatial distribution of releases relative to conspecific presence, soft versus hard releases, and temporal replication necessary to elicit a desired population response is warranted to maximize the efficacy of translocation.

MANAGEMENT IMPLICATIONS

The population growth we observed on all properties demonstrated by this wild bobwhite translocation program contributes directly and significantly to the population recovery goals outlined in NBCI 2.0. The partnership between private landowners, state wildlife agencies, and NGOs could serve as a model for similar programs in other areas. Creation of new population hubs through focused and intentional habitat management may serve as source populations for either local expansion or additional translocations improving the overall likelihood for population recovery of northern bobwhites. Local economic impacts to rural areas along with instilling confidence in landowners and managers on private and public lands wishing to attempt restoration efforts is value added to bobwhite conservation. Lastly, we submit that future translocations should carefully consider previous research and recommendations on maintaining (1) large target release area(s); (2) quality habitat and continued management on the release site(s); (3) holding and transport times; and, (4) proper timing of release to increase the probability and level of success warranted by a species of high socio-economic value and a limited resource.

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LITERATURE CITED

Brennan, L.A. 1991. How can we reverse the northern bobwhite population decline? Wildlife Society Bulletin 19:544–555.

Brennan, L.A. 2012. Closing remarks: are we whistling past the graveyard? National Quail Symposium Proceedings 7:367–369.

Brennan, L.A., J.M. Lee, and R. S. Fuller. 2000. Long-term trends of northern bobwhite populations and hunting success on private shooting plantations in northern Florida and southern Georgia. National Quail Symposium Proceedings 4:75–77.

Burger, L.W., D. A. Miller, and R.I Southwick. 1999. Economic impact of northern bobwhite hunting in the southeastern United States. Wildlife Society Bulletin 27:1010–1018.

Curtis, P.D., P.D. Doerr, R.M. Oates, and K.H. Pollock. 1989. Whistling cock indices as a measure of northern bobwhite harvest in North Carolina. Proceedings of the annual conference of the Southeastern Association of Fish and Wildlife Agencies 43:253–259.

DeMaso, S.J., F.S. Guthery, G.S. Spears, and S.M. Rice. 1992. Morning covey calls as an index to bobwhite density. Wildlife Society Bulletin 20:94–101.

Ellis, J.A., W.R. Edwards, and K.P. Thomas. 1969. Responses of bobwhites to management in Illinois. Journal of Wildlife Management 33:749–762.

Fleckenstein, N. 2013. The economic impact of the red hills region of southwest Georgia and north Florida. Tall Timbers Research Station and Land Conservancy. Tallahassee, FL.

Fleckenstein, N. 2014. The economic impact of the quail hunting lands of Georgia's greater Albany region. Tall Timbers Research Station and Land Conservancy. Tallahassee, FL.

Hanson, H.M. and F.S. Guthery. 2001. Calling behavior of bobwhite males and the call count index. Journal of Wildlife Management 29:145–152.

Janke, A.K., and R.J. Gates. 2012. Temporal variability in survival of non-breeding northern bobwhites in Ohio. National Quail Symposium Proceedings 7:194–201.

Janke, A.K., R.J. Gates, and T.M. Terhune II. 2015. Habitat influences northern bobwhite survival at fine spatiotemporal scales. The Condor. 117:41–52.

Johnson, J.L., D. Rollins, and Kelly S. Reyna. 2012. What's a quail worth? A longitudinal assessment of quail hunter demographics, attitudes, and spending habits in Texas. National Quail Symposium Proceedings 7:294–299.

Jones, J.G. 1999. Effects of relocating wild northern bobwhites into managed quail habitat in middle Tennessee. Thesis. Tennessee Technical University. Knoxville, TN, USA.

Liu, X., B.S. Mueller, D.S. Parsons, and D.R. Deitz. 2002. Movement patterns of resident and relocated northern bobwhites in east Texas. National Quail Symposium Proceedings 5:168–172.

NJ Fish and Wildlife. 2015. New Jersey Hunting and Trapping Digest. NJ F&W Webpage. http://www.state.nj.us/dep/fgw/pdf/2015/smgame_summary15-16.pdf. Accessed 23 December 2016.

Palmer, W.E., T.M. Terhune, and D.F. McKenzie, eds. 2011. The National Bobwhite Conservation Initiative: a range wide plan for recovering bobwhites. National Bobwhite Technical Committee Technical Publication. Version 2.0. Knoxville, TN, USA.

Parson, D.S., R.M. Whiting Jr., X. Liu, B.S. Mueller, and S.L. Cook. 2000. Reproduction of relocated and resident northern bobwhite in east Texas. National Quail Symposium Proceedings 4:132–136.

Rosene, W. 1969. The bobwhite quail: Its life and management. Rutgers University Press. New Brunswick, N.J, USA.

Sauer, J.R., J.E. Hines, J.E. Fallon, K.L. Pardieck, D.J. Ziolkowski, Jr., and W.A. Link. 2015. The North America breeding bird survey results and analysis 1996-2013. Version 01.30.2015 USGS Patuxent Wildlife Research Center. Laurel, MD, USA.

Seiler, T.P., R.D. Drobney, and T.V. Dailey. 2002. Use of weather variables for predicting fall covey calling rates of northern bobwhites. National Quail Symposium Proceedings 5:91–98.

Sisson, D.C., W.E. Palmer, T.M. Terhune, and R.E. Thackston. 2012. Development and implementation of a successful northern bobwhite translocation program in Georgia. National Quail Symposium Proceedings 7:289–293.

Stribling, H.L. and D.C. 2009. Sisson. Hunting success on Albany, Georgia plantations: The Albany Quail Project's modern quail management strategy. National Quail Symposium Proceedings 6:338–347.

Stoddard, H.L. 1931. The bobwhite quail: Its habits, preservation, and increase. Charles Scribner's Sons, New York, NY, USA.

Terhune, T.M. 2008. Effects of translocation on population genetics and demographics of a northern bobwhite population among a fragmented landscape in southwest Georgia. Dissertation. Athens, GA, USA.

Terhune, T.M., D.C. Sisson, H.L. Stribling, and J.P. Carroll. 2005. Home range, movement, and site fidelity of translocated northern bobwhite in southwest Georgia, USA. European Journal of Wildlife Research 51:119–124.

Terhune, T.M., D.C. Sisson, and H.L. Stribling. 2006. The efficacy of relocating wild northern bobwhite prior to the breeding season. Journal of Wildlife Management. 70:914–921.

Terhune, T.M., R.G. Hamrick, D.C. Sisson, and H.L. Stribling. 2009. Summer male call index relative to nesting chronology and autumn density of the Northern Bobwhite. National Quail Symposium Proceedings 6:54–64.

Terhune, T.M., D.C. Sisson, J.B. Grand, and H.L. Stribling. 2007. Factors Influencing Survival of Radio-tagged and Banded Bobwhites in Georgia. Journal of Wildlife Management. 71:914–921.

Terhune, T.M., D.C. Sisson, W.E. Palmer, B.C. Faircloth. H.L. Stribling and J.P. Carroll. 2010. Translocation to a fragmented landscape: survival, movement, and site fidelity of northern bobwhites. Ecological Applications 20: 1040–1052.

Wellendorf, S. W., W.E. Palmer, and P.T. Bromley. 2004. Estimating call rates of northern bobwhite coveys and censusing populations. Journal of Wildlife Management 68:672–682.

Wells, R. and K. Sexon. 1982. Evaluation of bobwhite quail surveys in Kansas. National Quail Symposium Proceedings 2:19–30.